

Claims

- [c1] 1. A method for use with an object experiencing multiple stress inducing events, the method comprising:
determining a stress distribution histogram for each event;
superimposing each stress distribution histogram to create a superimposed stress distribution histogram; and
calculating a critical plane based on the superimposed stress distribution histogram.
- [c2] 2. The method of claim 1 further comprising predicting the fatigue life of the object experiencing the multiple stress inducing events, wherein the prediction is based on the critical plane calculated from the superimposed stress distribution histogram.
- [c3] 3. The method of claim 2 wherein superimposing the stress distribution histograms comprises adding together at least two stress distribution histograms.
- [c4] 4. The method of claim 3 wherein predicting fatigue life comprises calculating a total damage caused by each event relative to the critical plane.

- [c5] 5. The method of claim 3 wherein calculating total damage further comprises (i) determining a mean stress correction factor; (ii) calculating the damage caused by each event in accordance with the mean stress correction factor; (iii) subtracting a damage error attributable to the mean stress correction factor from the damages calculated for each event; and (iv) adding together the damages calculated for each event after subtracting the damage attributable to the mean stress correction factor, wherein the damages are accurately added together because the damages are calculated with respect to the same critical plane.
- [c6] 6. The method of claim 5 wherein the mean stress correction factor is a largest stress determined from stress for all the events.
- [c7] 7. The method of claim 1 wherein superimposing the stress distribution histograms comprises weighting at least one of the stress distribution histograms prior to superimposing each stress distribution histogram.
- [c8] 8. The method of claim 7 wherein weighting comprises multiplying at least one of the stress distribution histograms by a correction factor.
- [c9] 9. The method of claim 1 further comprising adjusting

the stress induced by each event relative to the critical plane and calculating damage caused by each event based on the adjusted stresses for use in predicting fatigue life.

[c10] 10. The method of claim 1 wherein each stress distribution histogram includes a number of histogram bins populated with occurrences of principle stresses, and wherein superimposing the stress distribution histograms comprises adding together occurrences in common bins from all the events.

[c11] 11. A system for predicting fatigue life of an object experiencing multiple stress inducing events, the system comprising:
a computer for receiving signals from a deformation sensor, wherein the deformation sensor measures deformation of the object experiencing the multiple stress inducing events;
the computer calculating stresses for each event from the measured deformation, determining a stress distribution histogram for each event, superimposing each stress distribution histogram to create a superimposed stress distribution histogram, and calculating a critical plane based on the superimposed stress distribution histogram.

- [c12] 12. The system of claim 11 further comprising predicting a fatigue life of the object experiencing the multiple stress inducing events, wherein the prediction is based on the critical plane calculated from the superimposed stress distribution histogram.
- [c13] 13. The system of claim 2 wherein superimposing the stress distribution histograms comprises adding together at least two stress distribution histograms.
- [c14] 14. The system of claim 3 wherein predicting the fatigue life is based on a total damage to the object and the total damage is calculated by (i) determining a mean stress correction factor; (ii) calculating the damage caused by each event in accordance with the mean stress correction factor; (iii) subtracting a damage error attributable to the mean stress correction factor from the damages calculated for each event; and (iv) adding together the damages calculated for each event after subtracting the damage attributable to the mean stress correction factor, wherein the damages are accurately added together because the damages are calculated with respect to the same critical plane.
- [c15] 15. The system of claim 14 wherein the mean stress correction factor is a largest stress determined from stress for all the events.

- [c16] 16. The system of claim 11 wherein superimposing the stress distribution histograms comprises weighting at least one of the stress distribution histograms prior to superimposing each stress distribution histogram.
- [c17] 17. The system of claim 16 wherein weighting comprises multiplying at least one of the stress distribution histograms by a correction factor.
- [c18] 18. The method of claim 11 further comprising adjusting the stress induced by each event relative to the critical plane and calculating damage caused by each event based on the adjusted stresses for use in predicting fatigue life.
- [c19] 19. The method of claim 11 wherein each stress distribution histogram includes a number of histogram bins populated with occurrences of principle stresses, and wherein superimposing the stress distribution histograms comprises adding together occurrences in common bins from all the events.
- [c20] 20. A method for predicting a fatigue life of an object experiencing multiple stress inducing events, the method comprising:
 - determining a stress distribution histogram for each event;

weighting at least one of the stress distribution histograms;

superimposing each stress distribution histogram to create a superimposed stress distribution histogram;

calculating a critical plane based on the superimposed stress distribution histogram;

adjusting the stresses induced by each event relative to the critical plane;

determining a largest of the adjusted stresses stress;

determining new events by shifting each event based on the largest stress;

calculating damage caused by each new event;

calculating damage caused by the largest stress;

subtracting the damage caused by the largest stress from the damage calculated for each new event to determine corrected damage for each new event;

calculating total damage by adding together the corrected damages calculated for each new event; and

predicting the fatigue life of the object based on the total damage.